Geophysical Research Abstracts,
Vol. 10, EGU2008-A-06550, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-06550
EGU General Assembly 2008

The influence of heat convection in the subsurface energy transport equation on the ground heat flux and the energy balance at the land surface

S. Kollet (1), D. Schüttemeyer (1), R.M. Maxwell (2), A. Moene (3)

(1) Meteorological Institute, Bonn University, Germany (stefan.kollet@uni-bonn.de, +49 228 735186), (2) Atmospheric, Earth, and Energy Sciences Department, Lawrence Livermore National Laboratory, USA, (3) Meteorology and Air Quality Group, Wageningen University, The Netherlands

Land surface models (LSMs), accounting for the mass and energy balance at the land surface, constitute the lower and upper boundary condition in atmospheric and groundwater flow models, respectively. In LSMs, ground heat flux is a major component of the energy balance and is commonly parameterized through simple heat conduction. Therefore, energy transport via convection is neglected. This simplification largely decouples energy from mass transport in the subsurface.

In order to study, whether this decoupling affects the energy balance at the land surface, heat conduction and convection are incorporated into the parallel, variably saturated groundwater flow model ParFlow, which includes modularly the Common Land Model. The new simulator, ParFlowE, is applied to a unique data set from Wageningen, The Netherlands. The model output is compared to measurements including hydrologic and energy variables from the water table to the lower atmosphere. Furthermore, model output is compared to the simpler parameterization of the Noah LSM.

In a sensitivity analysis, the influence of convection on the ground heat flux and the land surface energy balance is characterized. Neglecting the process of convection may lead to errors in the energy balance especially after rainfall events and vertically upward redistribution of water and energy from the water table. In the simulations, the rarely measured temperature of rain introduces uncertainty and may require future

characterization in the field.